THE MIAMI CONSERVANCY BULLETIN

JUNE and JULY, 1921

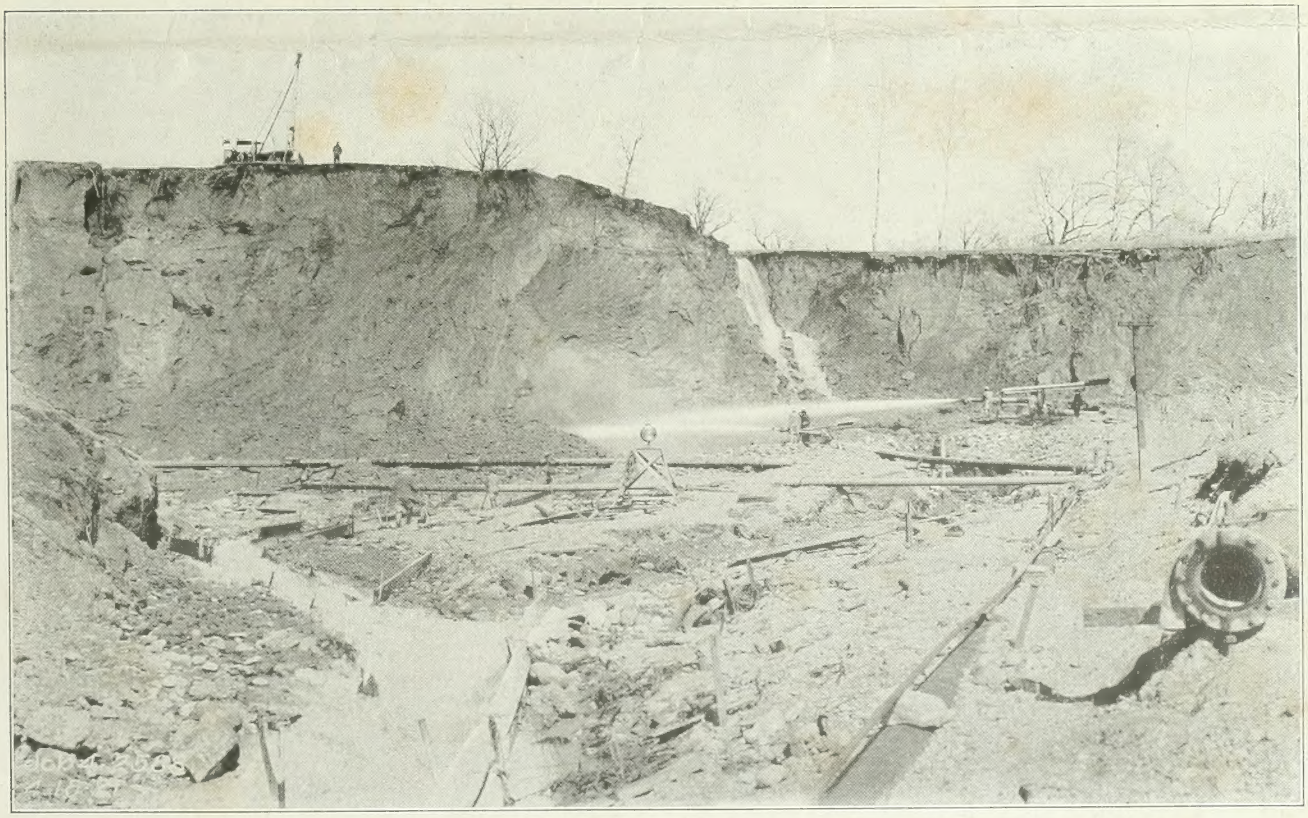

FIG. 318.—HYDRAULIC GIANTS EXCAVATING MATERIAL IN THE BORROW PIT AT TAYLORSVILLE, APRIL 18, 1921

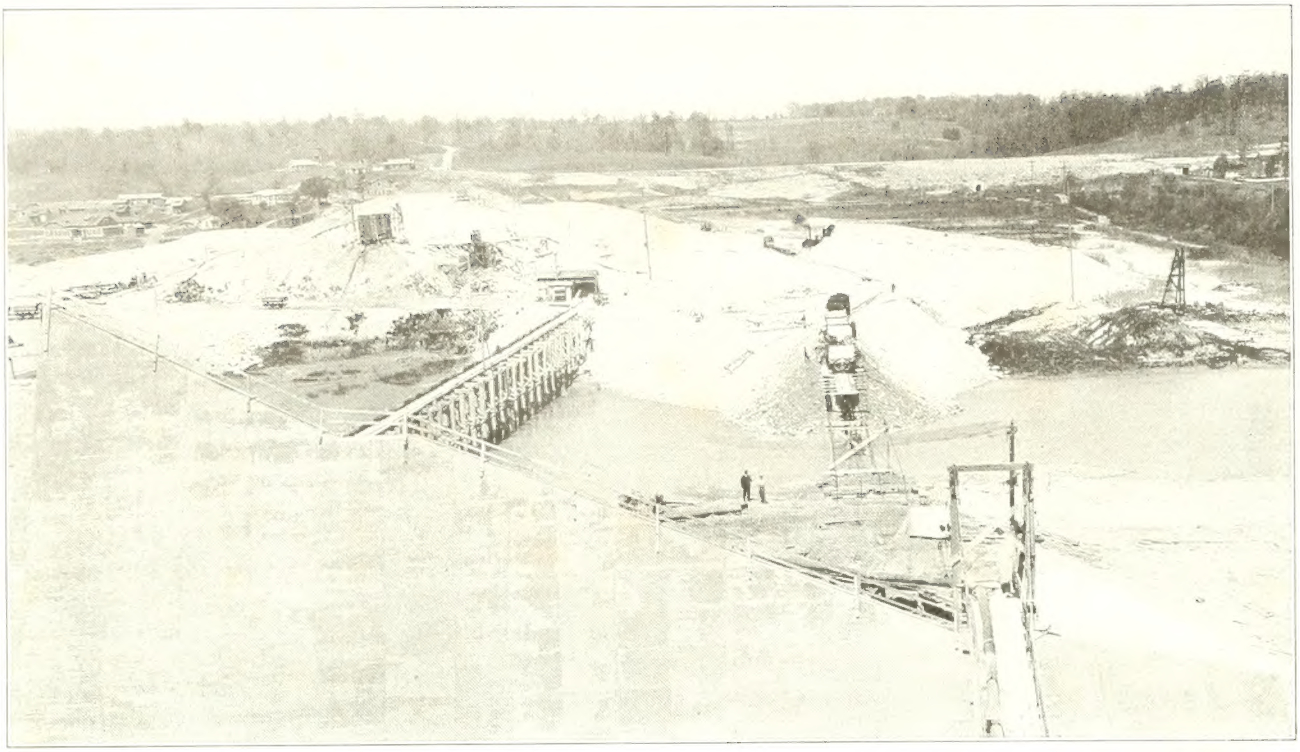

FIG. 319.—CLOSING THE OLD RIVER CHANNEL AT TAYLORSVILLE DAM, MAY 5, 1921.
This view was taken from the east side of the outlet structure and looking west along the north face of the dam. The steam shovel in the background is loading rock into four-yard cars. The rock is being used to push the rock blanket at the toe of the dam, across the old river channel. A train is shown on the swinging trestle.

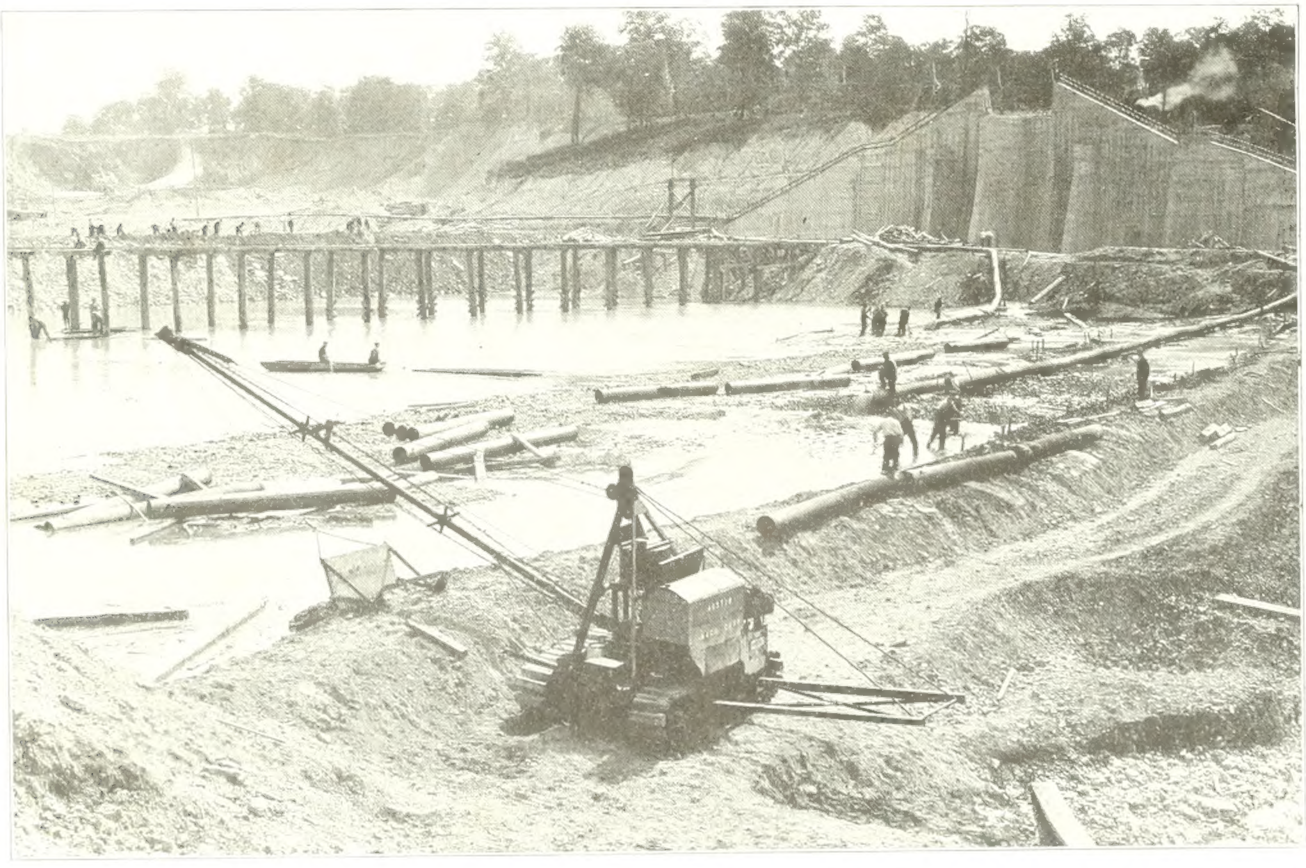

FIG. 320.—SLUICING MATERIAL INTO OLD RIVER CHANNEL AT TAYLORSVILLE DAM, JUNE 1, 1921
This view was taken from the west bank of the old river looking towards the outlet structure. An early stage of the hydraulic fill across the old river bed is shown. The trestle in the background has now been torn down. The fill in the background, on which the men are working, is the rock blanket on the upstream toe of the dam, placed by train from the swinging bridge shown in Fig. 319. The machine in the foreground is an Austin back filler, with caterpillar traction, and driven by gasoline. It is used to build up the toes of the dam.

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Subscription to the Bulletin is 50 cents per year. At news stands 5 cents per copy. Business letters should be sent to Office Engineer, Miami Conservancy District, Dayton, Ohio. Matter for publication should be sent to Bulletin Office, Miami Conservancy District, Dayton, Ohio.

Death of Judge Cosgrave

Judge Otway Cosgrave, formerly of the Common Pleas Court of Hamilton County, Ohio, died on Monday, July 25, 1921, after an illness extending over several weeks. Until his retirement a few months ago, Judge Cosgrave was a member of the Conservancy Court, representing Hamilton County, one of the nine counties comprising the Miami Conservancy District. He participated in all the hearings from the inception, including those incident to the organization of the District, the adoption of the Official Plan, and the confirmation of the appraisal roll. His sympathetic and intelligent grasp of the many intricate problems growing out of this enterprise, also his quick perception and understanding of the plight of an unprotected valley won the warm regard and gratitude of all. Judge Cosgrave interested himself in the progress of construction from the very first and always keenly enjoyed the annual trips of inspection. Although no longer on the bench, yet he was expected to accompany the Court on this year's inspection which had been postponed until September on account of the intense heat. It is much to be regretted that Judge Cosgrave did not survive to see the completion of the great project to which he had devoted so much thought and attention, both as a citizen and as a member of the Court.

Visiting the Conservancy Work

Visitors from all over the world come to the Miami Valley to look over the construction work. The organization, the methods of doing work, and the very size of the job, are unique, and will not be equalled in this country again for a long time.

While outsiders go to a good deal of trouble and expense to see the work, many citizens of the valley have never seen any of it. Many of them are planning to take an inspection trip over the work, but put it off from time to time. In a short while it will be too late. Englewood, Taylorsville, and Huffman dams are all very interesting right now. The Conservancy men welcome visitors on the work, and hope that more of the people of the valley will take occasion to inspect the work for which they are paying.

Future Issues of the Bulletin

This issue of the Bulletin has been edited by one of the members of the Engineering staff. Mr. G. L. Teeple, editor of the Bulletin since the start of its publication in 1918, has left the District for other fields of endeavor.

Under his guidance the Bulletin has been a true chronicle of the construction work, and has done much to foster the Conservancy spirit. The employes of the District wish him well in his new work.

A new editor will not be selected. The work of the District is rapidly drawing to a close, and there is no longer the need of a monthly Bulletin. This issue is a combination of the June and July numbers. In the future, Bulletins will be issued at irregular intervals, and each issue will mark the completion of some important feature of the work. The publication will be composed of articles and pictures similar to those that have made up the past numbers.

Persons who have subscribed in advance can leave their subscriptions stand. In the event that a balance is left to the credit of the subscriber when the Bulletin finally suspends publication, a refund will be made of the unused amount. Future numbers will be sold at the same rates as now prevail.

The Carrying Out of the Taylorsville Construction Program

Time lost through failure to move the Baltimore & Ohio Railroad on schedule has been made up, and dam will be finished in 1921.

In laying out a building program for a dam—that is, in determining in what order the several operations necessary shall be carried out—the vital factor is perhaps what is known as "stream control." At Taylorsville dam, where the stream to be controlled is the Miami river, this question is of unusual importance on account of the heavy flood flow, amounting very commonly to 20,000 cubic feet of water a second, (in 1913 to 125,000 cubic feet a second), which must be carried safely past the unfinished structure. Especially in damming a river which rises as rapidly as the Miami, the necessity of unusual care to see that sudden floods do not sweep away or inundate the exposed work during construction is evident. The essential principle of the stream control is to provide the amplest passage for the river at all times while the work is in progress.

In protecting the work at Taylorsville one feature of the valley landscape exercises an unusual influence. That is the old Miami and Erie canal embankment, still standing intact, forming a dam across the valley bottom 400 to 500 feet above Taylorsville dam site, sufficiently high to rise even above the flood of 1913, the entire flow being forced, even at that time, between the two stone abutments of the bridge which formerly carried the canal across the river. This action concentrates the destructive effects of floods in and near the river channel, which is here near the east slope of the valley.

The dam at Taylorsville, like most others, consists of two essential parts—the earth embankment forming the dam proper, and the channels which permit the river to pass by into the valley below. The program of stream control must have regard to both these parts.

In building the embankment, the chief danger is that the flood waters will rise and overtop the unfinished structure, washing parts of it away. At Taylorsville the portion west of the river was protected against the direct sweep of even great floods by the canal embankment referred to, and could never at any time be in serious danger. Work on it could be done at any time with only this precaution—that machinery, (as electric motors), which water would injure, must be capable of being lifted above flood level; and this could be easily arranged.

The building of the embankment across the river bed, however, faced a very serious danger in case of high water during the construction, since this section would be exposed to the full direct sweep of the flood waters coming through the opening between the canal bridge abutments. The solution was to postpone this section until after the Spring flood season—the real danger period,—and then push it up so rapidly during the following summer that it would be above flood danger line before another season of serious menace should come;—remembering that there is no record of a serious flood in the Miami valley during the summer period.

As for the building of the new concrete channels which should carry the river past the completed dam—the other chief portion of the construction—it was the heaviest feature of the entire Taylorsville work. The channels must be very large, being designed to carry a maximum flood flow of 55,000 cubic feet per second. The concrete structure must have a width of 241 feet, a length of 628 feet and a height of 111 feet. More than half the concrete had to be placed below ordinary river level. The extreme depth was about 40 feet below that level. The location being on the eastern hillside, an enormous "hole in the ground" had to be dug to receive it, carried far down into the solid rock; and being next the river a great earth cofferdam or dike had to be thrown up between the two to keep the work from being flooded in seasons of high water. The material to be excavated totaled 750,000 wagon loads, of which 250,000 wagon loads were rock. To do the work economically would require at least two years, during which time the danger of flooding equipment working at such depths below ordinary water level is evident.

The solution of this problem, as regards the excavating, was to do this part of the work by a dragline excavator, which could stand well above the flood level, (it stood 25 feet in fact above "mean low water"), while it reached down and brought up the materials from the depths below. The locomotives and cars which carried away the excavated material stood also at the same safe elevation as the dragline.

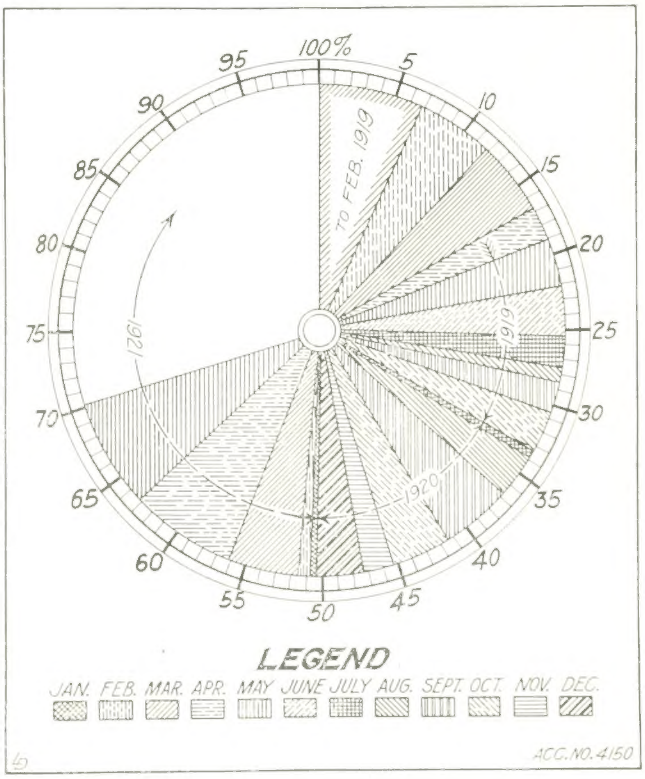


FIG. 319.—PROGRESS DIAGRAM.

The chart shows the monthly progress on the earth work of the Taylorsville Dam, in terms of per cent of the total amount of earth to be placed.

FIG. 320.—DEPOSITING MATER AL ON THE DOWNSTREAM SIDE OF TAYLORSVILLE DAM, APR. 1, 1921

The pipe line is being "backed up." A layer has been placed on the dam, starting at the east end near the water tank in the background and coming westward, by adding pipe as the area in front cf the discharge is filled in by material. Then the water in the pool has been raised, and another layer is being deposited by allowing the material to pile up in front of the discharge until the required depth is reached, and then pulling off a length of pipe and repeating the operation. The boards at the left are called "shear boards," are movable, and are used to deflect the current cf water flowing towards the pool, so that sand will not be crowded out into the section reserved for impervious core material.

As regards the placing of the concrete in the channel structures, the solution was also to place the entire concreting equipment above even extreme flood level, and lower the material into place in concrete buckets swung into position for dumping by derricks on the higher level. Only a few small pieces of equipment, like pumps, rock drills, etc., were permitted below water level, pieces of a size which enabled them to be lifted readily to safety by the derricks in case of emergency.

The river, during all this work, would be carried in its regular channel, with a wide shelf left on the valley bottom on its west bank, between that and the valley section of the dam, for flood expansion. This would mean, of course, that the building of the river section of the dam embankment must be postponed until the new concrete channels were ready to take the river flow; otherwise an expensive third channel— a "diversion channel"—would have to be dug to carry the river during the concreting.

One other important feature remains to be noted—the removal of the Baltimore and Ohio Railroad out of the way of the dam building. A channel for this "river of traffic" had to kept open at all times. The tracks ran along the lower portion of the west valley slope, while the Miami runs along the foot of the east slope, with the "valley section" of the dam between the two. The new tracks, pushed up the west slope to a higher safe level, must be built before the old tracks were abandoned. At the same time, the valley section of the dam could be built up to the level of the old tracks. Then, as soon as traffic took to the new tracks, the old ones must be removed and the valley section of the dam pushed on up.

"Orders for work" or the important features of the program would then stand as follows:

This chart supplements Fig. 319. It represents a profile taken along the center line of the dam, and shows the elevations reached by the fill during certain periods. The different elevations do not give a true picture of the quantities placed, but Fig. 319 does show the true relationship of volume and time.

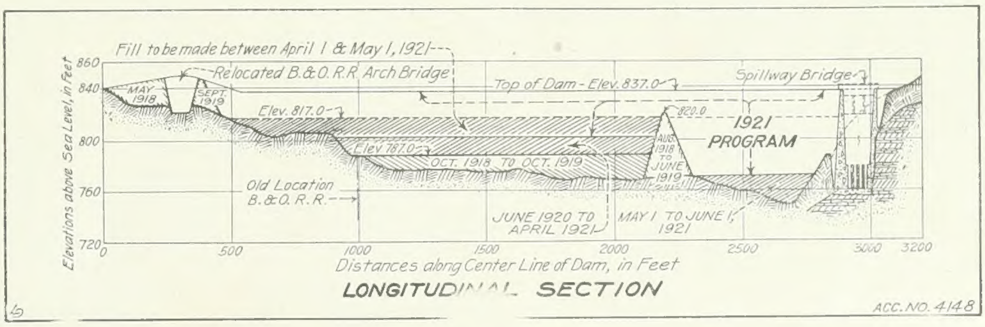


FIG. 321.—PROGRESS DIAGRAM.

During 1918 and 1919; clear the ground, get the equipment together, build the new B. & O. line and carry the valley section of the dam embankment up to the level of the old B. & O. tracks. If possible, also transfer traffic to the new tracks, remove the old ones, and carry the valley section on up as high as the season would permit. At the earliest possible date start excavation for the new concrete river channels, which would furnish the materials for the valley section. Start the concrete work as soon as the excavation permitted.

During 1920; finish excavation for the concrete and rush the concrete placing to completion during the warmer season. At the same time carry the valley section of the dam embankment up to within 20 feet of the proposed summit, which would be well above any possible flood. The river, during all three years, would be left in its regular channel.

In 1921; rush the river section of the dam embankment as fast as possible, beginning as soon as the Spring flood season should be past, to a point above flood damage; then carry the entire embankment up to completion. As soon as the river section should be well up, start on the concrete "spillway weir," and the bridge spanning it, and bring the entire work to completion as rapidly as possible. It was expected that some of this work would carry on into the season of 1922, but in any case the dam would be in safe condition against floods by the end of 1921. Also, it would be furnishing practically its full flood protection to the valley below at the same time.

It is a pleasure to be able to record that this program, although somewhat delayed in places—principally in connection with the shifting of the Baltimore and Ohio traffic to the new line—has on the whole been carried out in accordance with the plans and is now somewhat ahead of schedule. The vital parts of the work promise to be entirely finished by the end of the present season, unless something unexpected occurs.

The Work at Taylorsville Dam for 1921

As indicated in the preceding article, the job for 1921 includes two main parts—the finishing of the dam embankment and the topping out of the new concrete river channel with its "spillway weir" and bridge.

Of the embankment, the total quantity remaining to be done at the beginning of the year was about 850,000 cubic yards, (wagon loads). Of this amount, (except a very small quota of 10,000 cubic yards east of the river channel walls—about 457,000 cubic yards was to go into the yet untouched river section of the embankment, and the remainder into the valley section. The latter had already received about 400,000 cubic yards of material, which had carried it within about 35 feet of the proposed dam summit.

Since the river section, on account of its peculiar exposure to flood damage in its earlier stages, could not be started until the danger of Spring floods should be past, the early period of the 1921 work was devoted to carrying up the valley section still higher, reaching by the end of May a level of only

This drawing shows the dam as it existed on June 1, 1921, and as it will look when completed. The railroad is shown in its new location at the west end of the dam. A concrete bridge has already been built connecting the small piece of dam west of the tracks to the main fill. This bridge will carry the National Road, which will cross the valley on the top of the dam, over the railroad track, thus eliminating a dangerous grade crossing. The west section of the dam extends from the overhead bridge just mention to the west bank of the river. By June 1st, it had been built across the old location of the B. & O. and had been raised to spillway elevation. Before June 1st the river had been turned through the outlet structure and by that date the rock blanket on the upstream toe had been pushed across the old river channel. On the upstream face of the rock blanket left in place on the west section of the dam a machine is shown cutting the bank outside of the berm to a four-to-one slope.

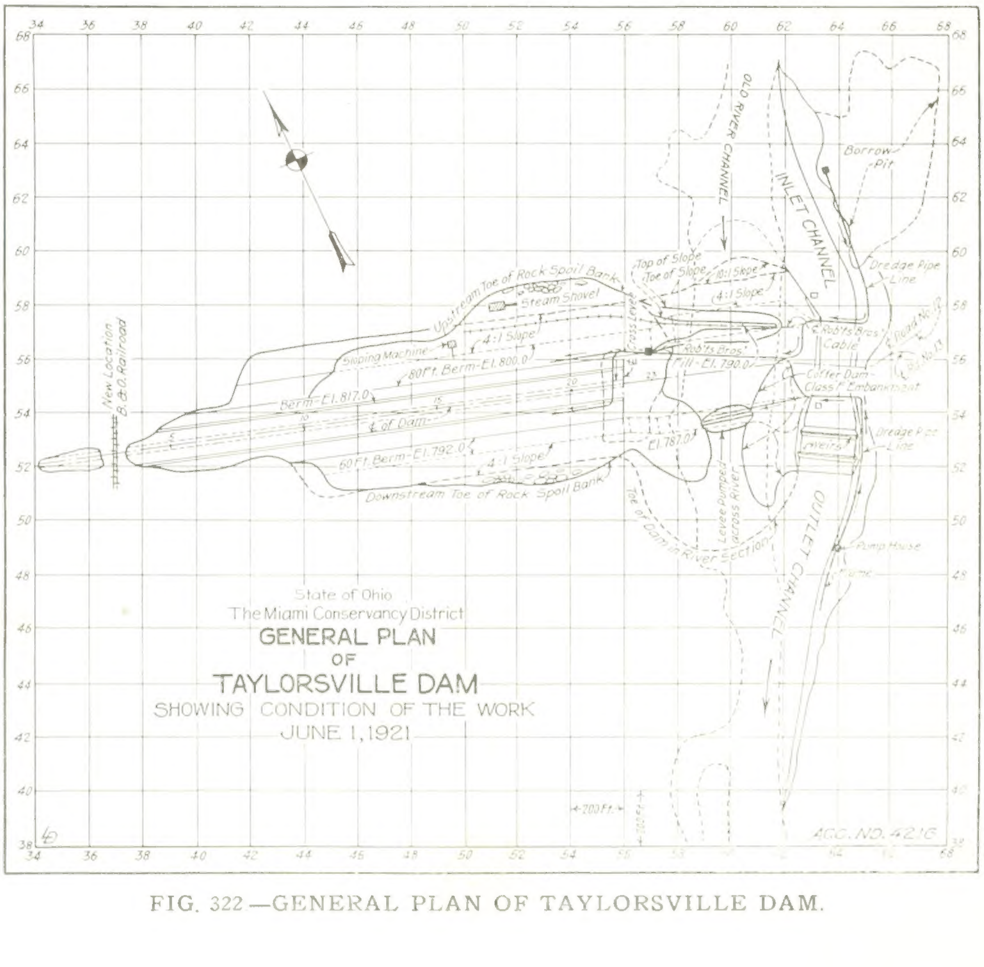


FIG. 322—GENERAL PLAN OF TAYLORSVILLE DAM.

These two sections show how the rock blanket will be located along the upstream and downstream toes of the dam proper. The so-called blankets are really massive buttresses reinforcing the base of the dam. The material in the "blankets" came from the excavation for the outlet structure and had to be disposed of in some manner, so it was put where it would add to the strength of the dam. The material is not suitable for use in the dam proper.

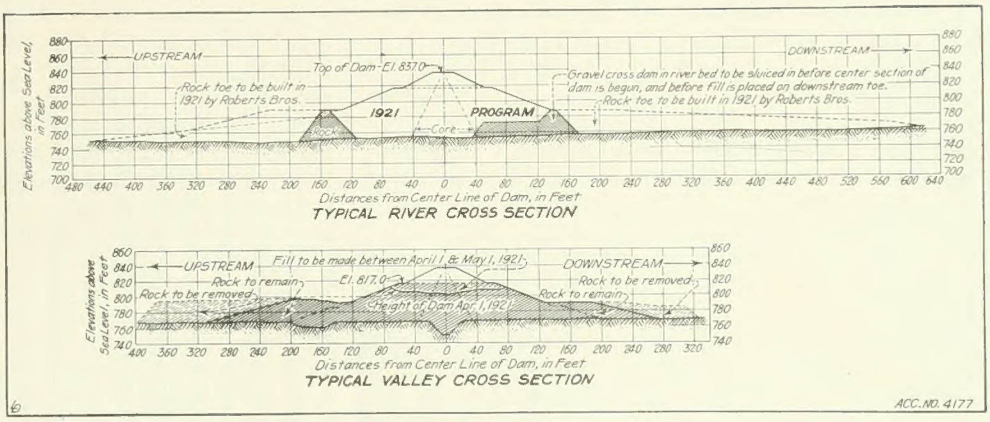


FIG. 323.—CROSS SECTIONS OF THE TAYLORSVILLE DAM.

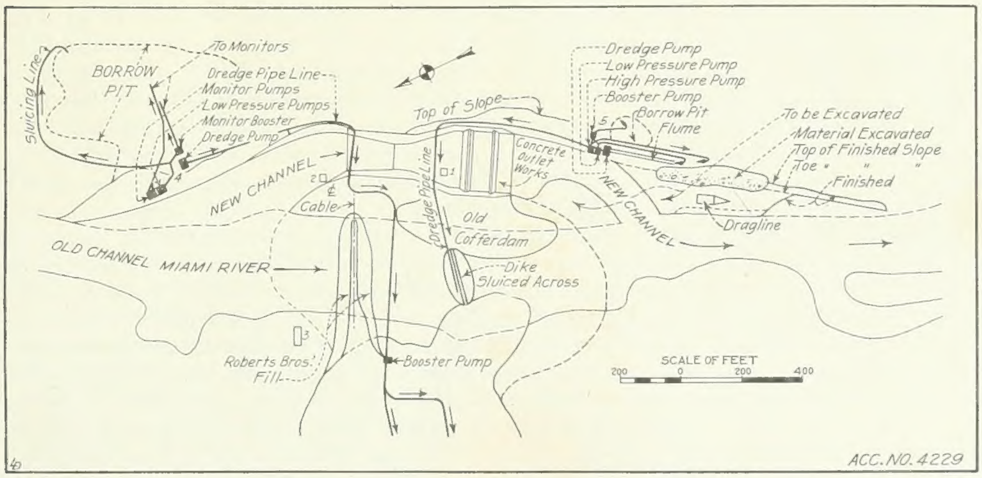
20 feet from the summit. Work on this section was then stopped, to permit a concentration of the entire embankment building equipment on the river section, to rush it to a safe level before it could be overtaken by high water. To expedite this, a new "borrow pit" was opened on the east hillside, thus providing a second source of earth material, with a complete outfit of equipment to carry it to the dam. By these means it is expected that the river section, already well under way, will be up to the same level as the valley section—and far above flood danger—by September 1. The two sections will then be thrown into one and carried up to completion together.

The danger of overflow of the river section was greatest naturally in its earliest stages, when the embankment was still at very low elevation. To diminish this danger a narrow dike was thrown rapidly across the river just at the upstream toe of the embankment, high enough to be above any probable rise of the water. This dike, which will become a part of the upstream toe of the finished embankment, was rapidly built by dumping rock from trains running on an overhead bridge as described later.

This preliminary operation was practically free from flood danger, and was done first as a protection for the next and really vulnerable stage—that of cleaning out the old river bed, and depositing the lowest layers of the dam core. To clean the river bed, a second dike was thrown across it by "pumping gravel" as in the regular operation of hydraulic fill, the location this time being just at the downstream toe of the dam. There was thus formed between the two dikes an enclosed rectangular basin occupying the damsite and filled with river water. This was pumped out, leaving the stream bed exposed, with its snags, muck and other material which would be undesirable to include in the embankment. These were then removed, the muck and similar earth material being washed down by a powerful water jet to a central depression or "sump," and pumped out as a thin mud. This operation has been completed, and the upstream crossdike carried to such a height that further interference by floods is practically eliminated.

The Borrow Pits Which Furnish Earth for the Dam

The earth for the entire dam embankment comes from "borrow pits" in the hillside just east of the river, where a blanket of clay and "glacial till" from 10 to 60 feet thick overlays the bed rock. It was this same material, overlying the rock excavated in digging for the foundations of the new concrete river channel, which was used in the earliest work in building the valley section of the embankment. The present borrow pits are simply extensions of this original excavation.



This sketch shows the layout of the plant and borrow pits, at the start of the work on the river section of the dam. The borrow pit south of the outlet structures is the new one opened up especially to supply enough extra material to push the river section along at maximum speed. Both the pipe lines are carried across the outlet structure on temporary suspension bridges, one above, the other below the weir. The pipe lines are so arranged that material can still be pumped into the west section of the dam if necessary.

FIG. 324.—LAYOUT OF PUMPING PLANT AT TAYLORSVILLE DAM.

The method of handling the earth is that of "hydraulic fill." The material is washed down from the pit face in the hillside by powerful water jets into a "sump" or cistern, whence it is pumped by big centrifugal dredge pumps through pipes to the dam summit and there deposited. (See Bulletin for February, 1920.) See also the pictures in this issue. Swiftly whirling paddles in the pumps suck the mixed earth and water from the "sump" into a cast iron shell, and whirl it out again into the "dredge pipes" at high velocity, on the same principle by which a stone is whirled from a sling. These pumps, driven by electric motors, consume up to a maximum of 450 horse power, the combination being very simple and efficient.

All the Taylorsville material is transported from the pits to the dam through pipes as just explained, there being here no possibility of directly "sluicing" the earth from the hill to embankment as was done last season at the north end of the Conservancy dam at Huffman. The direct sluicing, if available, would be cheaper. On the other hand, "pumping the mud" at Taylorsville is a little cheaper than transporting it by train and locomotive as must be done at Englewood and with most of the material at Huffman. The Conservancy dams at Taylorsville and Lockington are both fortunate having excellent material for the embankments close at hand on the hillsides, permitting excavation by "monitors," (water jets) which is a cheaper method than excavation by dragline or steam shovel, and eliminating also the expense of railway tracks, cars and locomotives for getting the excavated earth to the dams. This fortunate proximity of hillside material had of course something to do with the selection of these dam sites in the first place.

The principle difficulty at Taylorsville has been due to a thick layer of very tough "blue clay" 10 to 50 feet thick which underlies the surface material all along the east bank of the Miami in the neighborhood of the damsite. This material is so hard to "jet down" that it is necessary to "shake it up" first with dynamite. A well drill, (seen in Fig. 318) standing on the top of the bank, drills holes 60 feet deep, reaching to the level of the pit bottom, the holes being spaced 20 feet apart and 10 feet back from the bank edge. These holes are then "sprung" (enlarged) at the bottom by a small charge of dynamite, following which a charge of 500 pounds of "30 per cent dynamite" (30 per cent of it nitro-glycerine) is placed in the enlargement, and exploded, a number of holes being "shot" at once. This has a shattering effect on the entire mass, and makes the work of jetting it down by the "monitors" much easier.

As already stated, the speed of operation in pushing up the river section of the dam embankment is being accelerated by opening a second borrow pit. When this section has reached a safe height, (about 30 feet from the dam summit) one of these pits will be abandoned, and the remainder of the embankment finished with the other alone. That pit will be retained which is cheapest and easiest to operate—i. e., that which the previous working has shown to contain the least of the tough blue clay.

The original pit was opened by pushing out the excavation for the new concrete river channel, in a direction north and east, the sump and pumps being now about 500 feet north of the concrete inlet. See map, Fig. 324. Exploration by drilling has proved that some 700,000 cubic yards of earth material is within reach by extending this pit. This would probably be sufficient by itself to finish the dam embankment. The second pit, which is a little south of the concrete outlet, is known to contain also an abundance of material, so that whichever pit is used, there will be no lack in this regard.

Paying for the Flood Prevention Project

Tax Levies Made Approximately Equal Each Year. Bond Indebtedness Will Be Wiped Out Gradually, Last Payment Being Made in 1949

Stated in its simplest terms, the general scheme for obtaining the necessary money for the carrying out of the flood prevention project was to borrow it in such sums and at such times as it was needed, pledging the benefits to property as security for the repayment of the borrowed sums. The total amount thus borrowed has been $33,890,909.83, and it is expected that this amount will be sufficient to entirely complete the work. The total benefit to the property of the valley by protecting it from future floods, has been determined, after careful appraisal by men who were experts in the valuation of real estate, as being in round numbers $77,000,000.00. Thus the cost of carrying out the work, exclusive of interest payments on borrowed money, is expected to be less than half the benefit derived by the safeguarding of property alone, to say nothing of the far more important benefit in saving human life, and the freeing of the minds of the people from terror in seasons of floods.

The Miami Conservancy District, organized under a special "Conservancy Law" of the state of Ohio for the purpose of carrying out the project, is a political division of the state, comprised within land boundaries, after the analogy of a county or a town. Legally, like them, it is a public corporation, armed with all necessary powers to levy taxes, borrow money, take land by condemnation, and in general to do whatever may be necessary to the accomplishment of the work of flood prevention. The supreme authority is vested in a court made up of the common pleas judges of the several counties in the District. Executive direction is in the hands of a board of three directors appointed by this court, and reporting to it.

The security for the borrowed money was, of course, in the form of bonds. these bonds constituting a lien on the benefits to the property of the District and being paid off by taxes levied upon it. These bonds are arranged so that a certain number mature and are paid off each year, beginning in 1922 and ending in 1949, the debt of the District being thus gradually wiped out. Two bond issues were made, one in 1917, the other in 1920. The first covered the original estimated cost of the project. The second supplied the estimated necessary additional

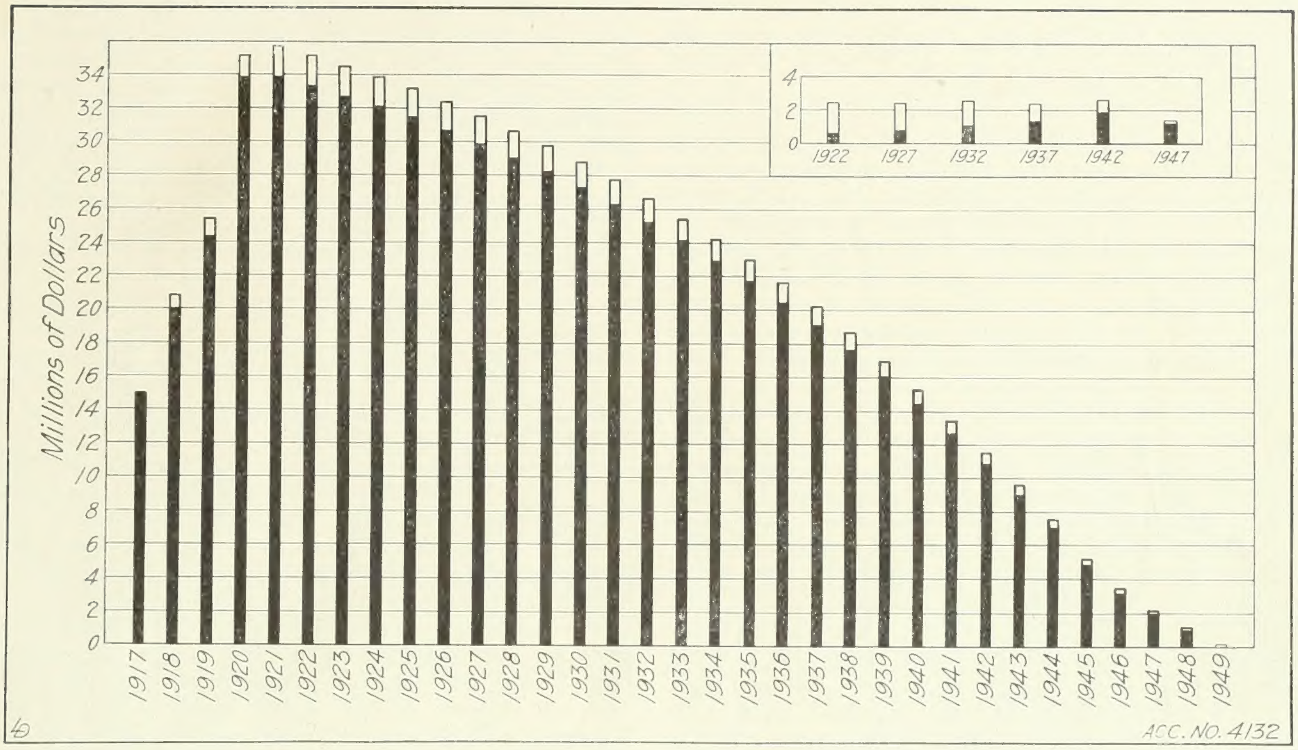


FIG. 325.—DIAGRAM SHOWING THE OUTSTANDING INDEBTEDNESS BY YEARS

This figure illustrates the successive borrowings of money through bond sales, and the proposed gradual repayment through tax levies. Any one of the series of black vertical strips represents the total indebtedness of the Conservancy District on December 1st of the year marked beneath. The little white blocks on top of the black strips represent in a similar way the interest paid during the year given beneath.

money to complete it, the original estimate having proved insufficient, due to the advance in all costs brought about by the war. The first issue was for $24,340,690.53; the second for $9,550,219.30; the two totalling $33,890,909.83. This will be the total indebtedness assumed by the District, the entire actual cost of the work of flood prevention, covering all features and items.

To save interest charges, these bonds were not sold in a lump, but from time to time as money was needed, in four installments, as follows:

Dec. 1, 1917	$15,000,000.00
Jan. 13, 1919	5,000,000.00
Jan. 3, 1920	4,340,690.53
Nov. 3, 1920	9,550,219.30
Total	$33,890,909.83

None of these have been yet retired. The total then represents the present debt of the District.

The monies thus borrowed must be repaid, as stated, by taxation on the benefited property (including, of course, the cities, counties, etc). Interest on the borrowed sums must also be paid in the same way. The intention is to make the tax levy as nearly uniform as possible year by year, a part of each levy being applied to paying the interest and the remainder to wiping out the principal, bit by bit, the process extending over a long period of time in order to reduce the levy to a reasonable sum each year. The reductions of the principal are made, of course, by paying off the sold bonds, these being arranged accordingly, a certain number calling for redemption each year. With this steady reduction of the principal, the annual interest to be met becomes likewise less and less; and since the total tax levy is to be kept the same each year, that part of it applied to reduce the principal becomes correspondingly greater and greater. Thus the debt is reduced faster and faster, till it is finally wiped out in full.

It should be added that the entire tax is applied as just explained, no portion whatever being directly used to pay for the work on the flood prevention project. The work is carried on entirely with the money obtained from the bond sales.

The facts regarding the successive borrowings of money through bond sales, and the proposed gradual repayment through tax levies are shown in Fig. 325. Any one of the series of black vertical strips in this diagram represents the total indebtedness of the Conservancy District on December 1 of the year marked beneath; that is, the amount of the yet unredeemed bonds. The bigger the debt the longer the strip, the scale being given at the left, in millions of dollars.

Thus in December, 1917, the District borrowed by bond sale to an amount of $15,000,000, represented by the left-hand black strip. In December, 1918, it borrowed $5,000,000 more, making $20,000,000 in all; represented by the second strip. December, 1919, it borrowed $4,340,690.53 more, making a total of $24,340,690.53; represented by the third strip. And in 1920 it borrowed $9,550,219.30 more, raising the total to $33,890,909.83; represented by the fourth strip. There will be no borrowings in 1921, therefore the fifth strip will be the same height as the fourth. In 1922, on the other hand, the debt will diminish by redeeming $600,000 worth of bonds; therefore the sixth strip is a little shorter than

the fifth. And each year thereafter, as more and more bonds are redeemed, the debt diminishes and the strips grow shorter, till in 1949 the last bond is redeemed—the debt wiped out.

The little white blocks on top of the black strips represent in a similar way the interest paid during the year given beneath. The first strip has no white cap, no interest being paid during 1917. The white block on top of the second strip represents the interest on the $15,000,000 during 1918; that on the third strip is the interest on the $20,000,000 during 1918, and so on. After 1922, when the debt begins to decrease, the interest also begins to decrease, and the white blocks grow shorter, along with the black strips.

But although the interest, after 1922, will steadily decrease as shown, the tax levy will not necessarily decrease, as already stated, since it is considered best for all concerned to make the total tax levy about the same each year. The effect of this in speeding the diminution of the debt is shown in Fig. 325 in the small diagram above and to the right of the main figure. A series of black blocks is there shown, each with a white block above it. Each black block represents the bond principal paid off during the year noted below, and the white block on top of it represents the interest paid during the same year. The total height of the two blocks, black and white, for any year, thus represents the total tax levy for that year, as applied to interest and principal. Note that this total height remains about the same for all the years shown, (except the last). The black blocks, however, grow higher as the years go on, and the white blocks shorter, showing the greater and greater proportion of the levy applied to principal, and the less and less proportion applied to interest. Thus in 1922 the black block is about one-fourth the total height, and the white block about three-fourths; while for 1942, the black block is about three-fourths and the white block about one-fourth, of the total. The diminished height of the black block in 1947 is due to the fact that in 1946 the entire first bond issue will have been paid off, leaving only the due fraction of the much smaller second issue to meet.

In what has been said, the tax levy, for simplicity, has been treated as if it were immediately and entirely applied to the debt, to pay principal and interest. But since there are always some people who fail to bring in their taxes, the levy must be made large enough to cover this shortage, and make the actual cash from the levy sufficient. To make sure of this, the levy is made large enough so that ten per cent of it can be set aside as a so-called "contingent account," leaving 90 per cent to be applied on the debt. As this contingent account grows larger, it will be used to pay off the bond principal, or to maintain the flood protection works in proper repair; in either case reducing the later tax levies. At least ten per cent of the tax levy for the current year, however, must be always kept in reserve to insure payments on the bonds in accordance with the schedule.

The taxes levied to pay for the project may be conveniently divided into two main classes, although in principle there is no actual difference, as all benefits are special benefits. The first includes the taxes levied upon the various political divisions of the District—upon each city, county, etc., because of the general benefit received by the city, county, etc., as a whole. In Dayton, for instance, various bridges and public buildings will be protected from flood damage. The city as a whole receives the benefit, and as a whole should be taxed to pay for it. Such benefits to a political division as a whole may be conveniently called general benefits.

But besides these general benefits, many houses and pieces of land on lower ground, in heretofore flooded areas, will receive a special private benefit. These special benefits will vary with the location. House-holders who were driven into the second story or onto the roof in 1913 will receive a greater benefit than the owner who suffered only from a flooded front yard and cellar. The taxes on these specially benefited properties constitute the second main class. This class carries a little more than one half the total load; the first class mentioned carries the remainder. Thus the owner of specially benefited property pays twice, once for his general benefit, and once for his special—which is fair.

The amounts of total benefits, both special and general, were determined in 1916, after a very thorough-going examination of the property of the District by experts in real estate valuation; and the benefits as so determined were made the basis of a just distribution of Conservancy taxation between the two classes just discussed, and between the several political divisions of the District on which the first class are assessed. The findings of these experts were approved by the Court, and the distribution of the benefits, as given by them, and so approved, is the basis on which the actual Conservancy taxes are calculated and levied.

The tax levy for general benefits—that made through the political divisions—is collected by the several cities, counties, etc., and paid into the Conservancy treasury. It is assessed as a general Conservancy tax, so many mills to the dollar of property as carried on the regular tax list of each political division. Since the various cities, counties, etc., receive different degrees of benefits from the protection works, according to their varying degrees of liability to flood damage, this general mill levy will vary with each political division. In Dayton, in 1918, this levy was 2.845 mills to the dollar, to be added to the general city tax. In 1919, it was 2.39 mills; and in 1920, it was 2.993 mills. Its amount in 1921—the current levy—has not yet been determined.

The taxes on the specially benefited property have to be handled, naturally, in a different way, since the special benefit to each particular property will vary with the depth of flooding, etc., to which the property would be subject but for the flood protection works. For such properties a special tax list is kept in the District offices, on which each piece of property, with its benefit, is entered. The tax levy on each of these properties is calculated each year, as a percentage of the total levy to be laid on the particular property to carry out the project. This total levy is laid in proportion to the benefit to that property, and the percentage of it levied for any year is the same all over the District. Each year's levy, as well as the total levy, is therefore proportional to benefit. The county tax list thus made

out is sent each year to each county auditor, to be collected with the other county taxes.

Up to the present year, the total levy on this class of property has been 36 per cent of its benefit; corresponding with the 36 per cent of total benefit levied on all the property of the District. It was this which produced the credit necessary to borrow the $24,340,690.53 constituting the first bond issue, and covering the original estimate of the cost of the project. The per cent of the total levy actually assessed for 1918 was 6.8 per cent; for 1919, 5.6 per cent, and for 1920, 7.7 per cent.

To show just what this meant to the individual property holder, take the case of a house and lot on land, worth, with flood protection, $5,000. Without protection it would be liable to flood damage and its value would drop, say to $4,000. Its benefit from flood protection is therefore $1,000. The total levy upon it to finish the project, heretofore placed at 36 per cent of the total benefit, as just explained, would be 36 per cent of the $1,000 or $360. The 6.8 per cent of this total levy, laid in 1918, would have been $24.48 (6.8 per cent of $360). In the same way the 1919 levy upon it would have been 5.6 per cent of $360, or $20.16; and the 1920 levy would have been 7.7 per cent of $360, or $27.72.

The total levy, in dollars, including both the classes of benefited property discussed, was in 1918, $1,804,308.00; in 1919, $1,492,638.77, and in 1920, $2,058,231.78.

With the increased cost of the project over the original estimate, due to advance in all costs on account of the war, an addition to the total levy on benefits was made necessary in November of last year, amounting to 14 per cent of total benefits. This makes the total levy at present 50 per cent of the total benefits, and this levy must hereafter be made on each separate piece of benefited property. Applied to the property just considered, with a benefit of $1,000, it will make the total levy on that property $500. Thus the annual tax levy in future on that property would have to be reckoned on this $500 instead of $360 as before.

On the political divisions of the District the same additional 14 per cent will be levied on their total benefit.

This advance will first appear on the tax list for the present year, 1921. The amount asked for is $3,418,598.28. In this is included the balance needed for paying the bonds which mature December 1, 1922, as well as interest for one year on the full amount of the first issue of bonds, and interest for two years on the second issue. The designations "first" and "second" are for convenience, as the issues are in all respects on a parity. In the above figure is also included a sum for maintenance of works for the year 1922, when they will have reached substantial completion.

Collecting the above facts for convenient inspection, we get the table shown below.

May and June Progress on the Work

GERMANTOWN

The only work now remaining to be done is the placing of a 2-inch Tarvia surface layer on the concrete floor of the highway bridge spanning the spillway structure.

It is expected to complete this surfacing at an early date.

A. L. Pauls, Division Engineer.

June 30, 1921.

ENGLEWOOD

During May the hydraulic fill operations were continued in the gap between cross dam No. 2 and the permanent spillway, using sump No. 3 until May 4th when sump No. 4 was put into use. During June the gap was brought up to the level of the remainder of the dam and sluicing operations were started over the entire length of the fill and will be continued in this manner until the dam is finished. Up to the end of June a total of 2,781,450 cubic yards have been placed. The record for a single shift was advanced to 615 cars, for a two-day shift run (day and night) to 1040 cars, and for a week's run to 5730 cars.

Concreting at the permanent spillway was begun April 19, and is making satisfactory progress. By the end of June the floor and side walls were well advanced towards completion and preparations were begun to place the weir.

Rock too large to go through the pumps have been screened out of the material coming from the borrow pit and have been placed on the upstream face of the dam.

The contract has been let for the construction of road No. 7 near West Milton and the contractor is preparing to start at an early date.

H. S. R. McCurdy, Division Engineer.

June 30, 1921.

LOCKINGTON

During the last two months fair progress has been made in placing the hydraulic fill, and on June 30 only about 50,000 cubic yards remained to be placed. As a result of the operations of the last two months, it appears that the dam can be completed without resorting to the help of a booster pump in either dredge-pipe line. The pump house that was burned on the night of April 16 was in operation on the morning of April 25, resulting in a loss of an even week's time.

The operations on the spillway weir with the two conduits and bridge over the spillway, were started. By June 30 about 1200 cubic yards had been placed and the conduits were completed and work is in progress on the weir. The screening and mixing plant in its original location is being used to supply concrete. A gasoline dinkie with buckets on flat cars transports the concrete from the mixer to the derrick over a 36-inch-gauge track built on a low trestle in the entrance channel. A derrick, with a 120-foot mast and a 105-foot boom, with a steam hoist, has been set between the walls of the outlet structure on the timber frame about eight feet above the water. This derrick is hoisting the concrete buckets to the forms. Gravel is being supplied to the screening plant by a steam dragline which dumps the gravel directly into the hopper of the gravel plant.

The roadway on top of the west 3000 feet of the dam, which was built by dragline the last year, has been graded and partly graveled. The slopes on this portion of the dam have been trimmed and partly seeded in grass.

The work on road No. 11 has been completed. The earth in the large fill on road No. 9 has been placed and the road will be regraded after settlement before the gravel roadbed is placed. Within a few days the road will be opened to light traffic.

Barton M. Jones, Division Engineer.

June 30, 1921.

TAYLORSVILLE

During May the north sluicing plant made good progress pumping into the section of the dam west of the river. By the end of the month this section was up to elevation 821, or 3 feet above the spillway, and 16 feet below the dam crest. The last of the month pumping into the river section was started in earnest, as the river bottom had been cleared out and prepared to receive the filling. During June rapid progress was made on the river section, using in the main material from the north sluicing plant. Very little material from the south sluicing plant was deposited in the dam during May, as the motor from the dredge pump was used on the dredge pump operating in the river bottom, while the river work was being done. Better results were obtained during June from the south borrow pit than

[illegible] at this point somewhat, [illegible] on the dragline.

[illegible] across the old river channel, [illegible] and the plant [illegible] by the last of June.

The [illegible] has been [illegible] and [illegible] that part of the dam embankment east of the outlet works. [illegible]

O. N. Floyd, Division Engineer.

June 29, 1921.

HUFFMAN

[illegible] 1,012,000 cubic yards, leaving a balance of 298,000 cubic yards to be placed.

The outer slopes of the main post of the dam, north of the outlet works, are up to elevation 820 or 24 feet below the top of the dam. About 75% of the material being placed [illegible] by the dragline [illegible] the dam.

[illegible]

C. C. Chambers, Division Engineer.

June 30, 1921.

DAYTON

[illegible] D-16-16 has completed the channel excavation between [illegible] construction of a coffer-dam and pumping in order to permit the machine to travel on a grade low enough to afford sufficient clearance. The next work for D-16-15 will be the lowering of a water main opposite Columbia street. D-16-19 [illegible]

[illegible] street bridge, opposite DeKalb street, at the southwest wing wall of Dayton View bridge, and at the southeast wing wall of Fifth street bridge. Land walls are in course of construction at the Platt Iron Works, at Backus street, [illegible]

[illegible] undertake the work from Keowee street to Webster street. [illegible]

C. A. Bock, Division Engineer.

June 30, 1921.

HAMILTON

[illegible] during May and June on the west side of the river at the lower end of the improvement. [illegible] has been hauled [illegible] Peck's Addition. [illegible]

During May the [illegible] piled up a sufficient amount of gravel to finish concreting the Black street bridge. It was then moved to the west side of the river and is now working on the levee between Main street and the Champion Coated Paper Mill.

[illegible] and part of arch 7 of the Black street bridge have been concreted during the past two months. [illegible]

[illegible] has been completed except for [illegible]

During May, grading was in progress for the revetment [illegible] and during June rapid progress was made with the laying of blocks and slope revetment between Main street and the Columbia bridge.

C. H. Eiffert, Division Engineer.

June 30, 1921.

UPPER RIVER WORK

Piqua. During May [illegible] north end southward to within 1200 feet of the Main street bridge. [illegible]

Albert Schroeder, Assistant Engineer.

June 30, 1921.

Troy. During May dragline D-16-21 completed 1500 feet [illegible] east levee alone.

[illegible] getting ready to place about 2000 cubic yards in the north approach of the Market street bridge.

[illegible] street bridge on May 7, and have completed the sheeting [illegible]

Tippecanoe City. [illegible] was started on the sewer.

A. F. Griffin, Assistant Engineer.

June 30, 1921.

LOWER RIVER WORK

Miamisburg. [illegible] the gas line crosses the river. The machine was then moved north under the Linden avenue bridge and has built [illegible] are nearly done with their contract.

The work of paving the Main street elevation has been [illegible]

fall were relaid after being cleaned. The pavement between points 200 feet each way from this summit will be 21 feet wide between curbs. To divide the traffic over the hump a concrete marker 12 inches wide has been placed in the center of the pavement flush with the brick.

On Fourth street the District has completed 625 feet of 24-inch sewer from Sycamore Creek to Pearl street.

Franklin. During May the dragline cut away the point of land opposite the spillway, and threw the material back to be used again. The machine then started to build the new hydraulic levee, but did not continue, as this necessitated running in the present site of the hydraulic, where the only material available was so soft and mucky that it was dangerous to move the machine over it. In June the dragline was widening the river channel. Material was being placed in the levee north of the paper mill.

Price Bros. have been making such good progress on the head and tail races that both structures will be completed about the middle of July.

Middletown. Except for a man cutting weeds and filling washes on the levee, there has been no work done in Middletown since the last report.

F. G. Blackwell, Assistant Engineer.

July 30, 1921.

RAILROAD RELOCATION

Big Four and Erie. The Erie passing tracks and team tracks have been ballasted and the salvaging of old rail and material is practically completed. No new work is in progress.

Ohio Electric. The masonry for the extension of the Mad river bridge is completed. Roberts Bros., of Chicago, to whom the contract for laying the track was let, have the rail torn up on the old line around the aviation field and have relaid it for a distance of two miles and have also distributed ballast on the track already laid.

Baltimore and Ohio. Completed.

Albert Larsen, Division Engineer.

July 30, 1921.

RIVER AND WEATHER CONDITIONS

April, 1921

At the Dayton Weather Bureau station the total rainfall during the month of April amounted to 3.42 inches, about 0.52 inches more than normal. At the District's stations the amounts varied from 4.68 inches at Ingomar to 3.63 inches at the Taylorsville dam. No floods of importance occurred, the only rises being two small freshets which caused five-foot stages at Dayton on the 9th and 17th.

At the Dayton Weather Bureau station the mean temperature for the month was 55.6 degrees, or 3.6 degrees greater than normal; there were 12 clear days, 8 partly cloudy days, 10 cloudy days, and 12 days on which the precipitation amounted to .01 of an inch or more; the average wind velocity was 11.3 miles per hours, the prevailing direction being from the southwest; and the maximum velocity for five minutes was 48 miles per hour from the southeast on the 16th.

May, 1921

The rainfall for May was distributed throughout the month in a number of small showers. At the Dayton Weather Bureau station the total amounted to only 2.26 inches or 1.62 inches less than normal. At the District's stations the amounts varied from 4.75 inches at the Englewood dam to 1.74 inches at Ingomar. The rivers were low during the entire month, except for a very slight rise on the 27th which amounted to 3 feet at Dayton.

At the Dayton Weather Bureau station the mean temperature for the month was 64.0 degrees, 1.3 degrees greater than normal; there were 16 clear days, 10 partly cloudy, 5 cloudy days, and 11 days on which the precipitation amounted to .01 of an inch or more; the average wind velocity was 9.6 miles per hour, the prevailing direction being from the northeast; and the maximum velocity for five minutes was 39 miles per hour from the northeast on the 5th.

June, 1921

The rainfall for June was considerably below normal at most stations in the Miami Valley. At the Dayton Weather Bureau station the total amounted to only 1.13 inches, or 2.83 inches less than normal. At the District's stations the amounts varied from 6.24 inches at the Lockington dam to 1.01 inches at Ingomar. The rivers and streams were all very low, except for a small rise on the 23d which amounted to 3 feet at Dayton.

At the Dayton Weather Bureau station the mean temperature for the month was 75.4 degrees, 3.3 degrees greater than normal; there were 14 clear days, 14 partly cloudy days, 2 cloudy days, and 13 days on which the precipitation amounted to .01 of an inch or more; the average wind velocity was 8.6 miles per hour, the prevailing direction being from the northwest; and the maximum velocity for five minutes was 48 miles per hour from the northwest on the 18th.

Ivan E. Houk, District Forecaster.

June 30, 1921.

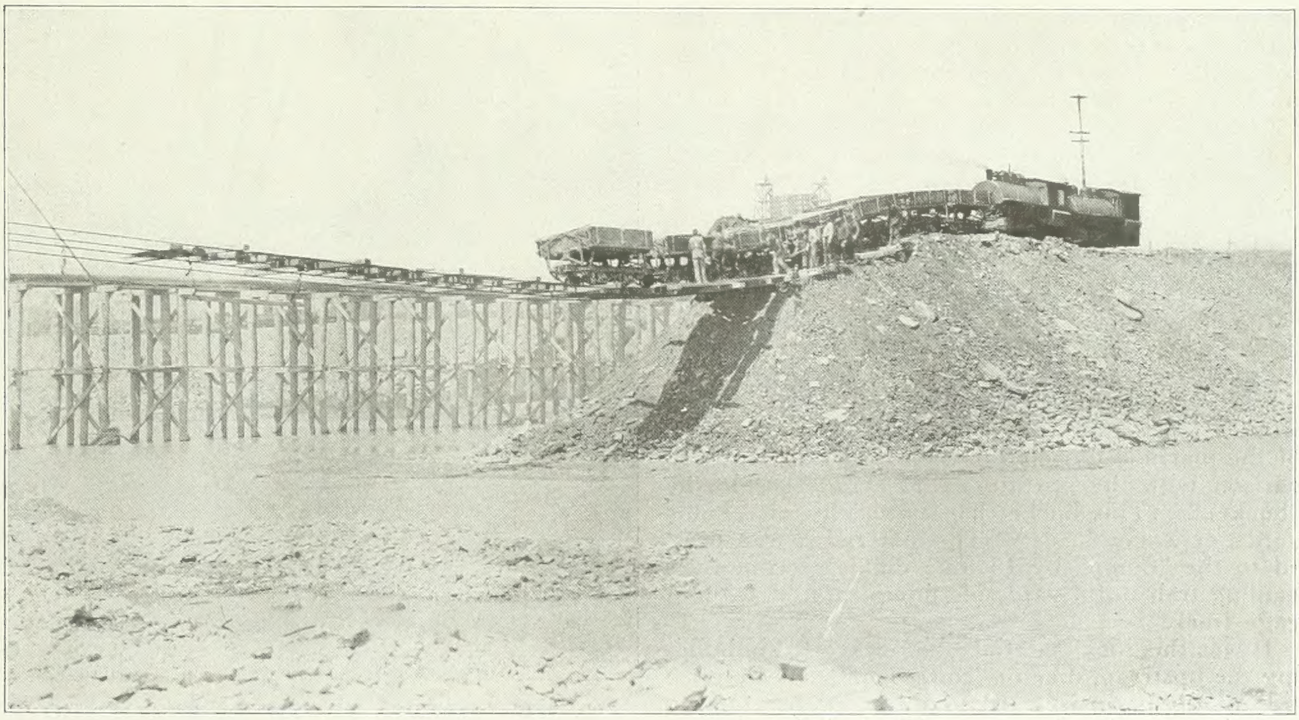


FIG. 326.—THE SWINGING TRESTLE AT TAYLORSVILLE.

The Rock Blankets at the Toes of the Dam at Taylorsville

An important question in laying out the original program for the Taylorsville work was what to do with the large quantity of rock which it was necessary to dig out east of the river to reach solid foundation for the new concrete channel. This material was shale rock (Cincinnatian) thickly interleaved with layers of clay, the whole mass sloughing on exposure to such a degree that it was not considered safe to use in building the dam embankment on account of the danger that it might "grease up" and slide when wet. (Like the material in the famous Culebra cut at Panama.) It was therefore rejected as regular embankment material. It would have a real value, however, if placed against the upper and lower toes of the regular embankment, (even if it should slough somewhat), in reinforcing and buttressing the embankment by its weight and mass. It was decided thus to use it. Very little of it, however, could be deposited at once in the river section of the embankment, since this section must be kept open to take the stream flow. It was practically all placed along the toes of the valley section, whence the part for the river section could be moved into place later.

The river section being scheduled for this season, the contract for this necessary second moving of the rock material into the river section was placed with Roberts Bros. early in the year, the same firm which did the track laying on the new B. & O., Big Four and Erie railway lines. This work is now in progress. The total amount originally placed in the valley section was about 335,000 cubic yards. (In its original place as bed rock in the east hillslope it measured 231,000 cubic yards, the difference being due to the breaking up of the solid material into loose pieces.) For the river section, about 80,000 cubic yards will be taken from the upstream toe, and 50,000 cubic yards from the downstream, and moved eastward into its final place. (A small proportion of this in each case will go westward, to cover ground originally inaccessible on account of the interference of the old B. and O. R. R. tracks.) The total rock to be moved is thus about 130,000 cubic yards. The result when complete will be a rock blanket or layer extending the full length of both dam toes, 20 to 25 feet in maximum thickness, its upper part forming a level shelf or "berm" 80 feet wide on the upstream side, and 60 on the downstream, and sloping from these berms on a very flat (4 to 1) slope down to the original valley bottom.

The material is being dug by a 70 ton Bucyrus railroad steam shovel, a machine of a powerful type built to make "play" of that sort of heavy rock work. The power and size of the "business end" of the machine is well shown in Fig. 327, by comparison with the operator, who stands beside the "bucket." (This bucket has a capacity of 3 cubic yards, or wagon loads.) The material is transported to the "dump" by 18 ton "dinkie" locomotives hauling trains of 4 yard side dump cars on a 3 foot gage track.

It was this rock material which was used in building the upstream dike or "cofferdam" enclosing one side of the basin referred to above, preparatory to cleaning out the river bed. The building of such a dike by dumping from dinkie trains constituted an interesting problem in engineering, the river surface being about 20 feet below the high bank from which the trains must be run out, and the bottom from 7 to 10 feet below that. The problem was solved by "making the train walk a tight rope" stretched across the stream. The operation is shown in Fig. 319 and 326. Really four parallel "tight ropes" were stretched, of 1⅜inch steel cable, and about 4 feet apart. Railway ties were laid and fastened across these cables, forming a broad horizontal rope ladder on which the rails were spiked. Upon this structure, built level with the high river bank at this point, the loaded trains are carefully pushed out "hind end to." This was to avoid placing the excessive weight of the locomotive on the structure. Also, the cars being successively dumped just as they ran out on the suspended structure, the latter never had to bear the weight of more than one loaded car, those farther out being empty. The dumped material formed a rock embankment, the smaller upper rocks of which, tamped under the cross ties by trackmen, formed a rock ballast, the whole constituting a track structure amply able to bear the weight of the locomotives and loaded cars.

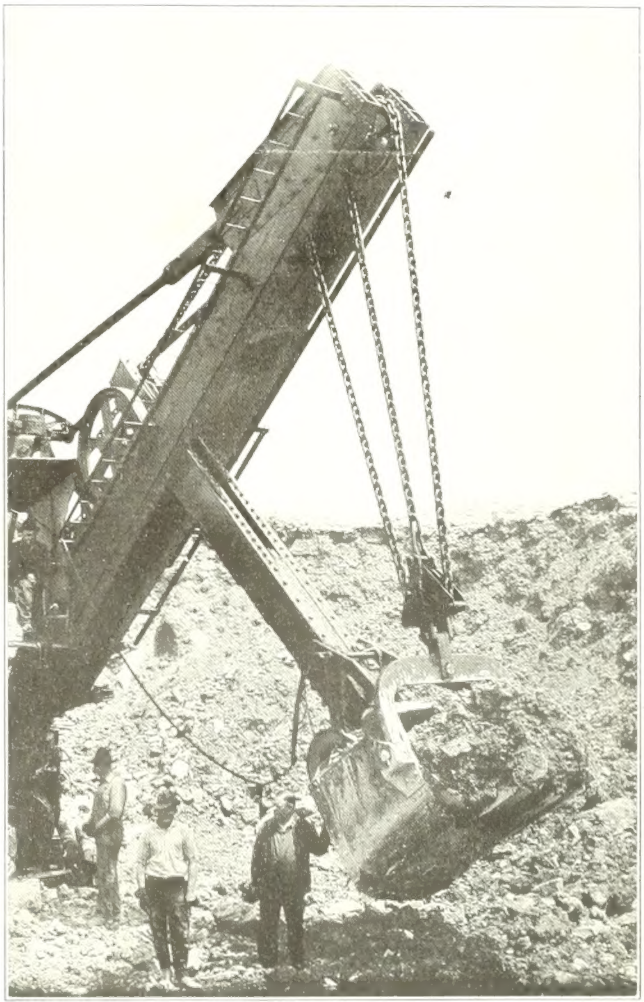


FIG. 327.—ROBERTS BROTHERS STEAM SHOVEL JUNE 1, 1921.

Plastic Fill Method Again Used at Taylorsville

East of the outlet structure at Taylorsville is a section of the dam which reaches from the east wall of the outlet to the hillside. It is only about eighty feet long on top, and the profile is triangular in shape, with one point at the hillside at the east end of the dam, another point where the top of the dam intersects the east wall of the outlet structure, and the third where the natural ground intersects the wall, at a point forty-seven feet below the top of the dam. Eight thousand cubic yards of material are in this embankment.

This particular piece of work has just been finished. The work was really back-filling behind the outlet structure wall. It was not economical to install the plant necessary for sluicing the material into place, and so the use of teams and the plastic fill method was decided upon. The material was obtained from the hill just north of the fill. The material was till, similar to the material used in the main dam. It was dug from the borrow pit and loaded into wagons with a Keystone excavator.

The material was placed in the fill in horizontal layers not to exceed five feet in thickness. In order to make the fill around the concrete wall, which was placed first, the loaded wagons had to be taken down the hillside, which is on a two-to-one slope. Horses could not hold the wagons, nor handle them down at the bottom against the wall. Therefore a J. P. caterpillar tractor, shown in Fig. 328, was used to handle the wagons. The wagon tongues were removed and a short, stout wooden block substituted. No trouble was experienced in handling the loaded wagons with this rig. The outfit was able to stop on a two-to-one slope within a few feet, and made the turns in the narrow space between the walls and the hillside without difficulty.

As the fill was raised, the grade reduced and enough level space made on top of the fill so that the danger of smashing the horses and wagons against the concrete wall was passed, teams were used to haul the wagons.

The material was placed in horizontal layers not exceeding five feet in thickness. The coarser material was placed on the outer slopes, the finer in the center of the fill. There was not much selection of material necessary, as all of it would make a fill impervious to water. The layers of material were hauled over by the tractor and the teams. To further consolidate the fill, the so-called "plastic fill" method was used. This method was described on page 101 of Volume 2 of the Bulletin, and was there given the name that has stuck to it ever since.

On the fill just finished water under pressure was delivered to the site of the work by a pipe line from the pumps. A hose attached to the pressure line carried the water to the nozzle, which consisted of a long piece of gas pipe. The nozzle was pushed down through the layers of earth, just like a hypodermic syringe is used, introducing the water into the mass by injection. Injections of water were made two to three feet apart. On the outer slopes enough water was introduced to cause consolidation, but not to cause sidewise movement of the mass. In the center of the dam more water was added than on the slopes, so that thorough saturation and consolidation took place. At the junction of the fill with the concrete wall a pool of water was maintained.

Special care was taken to make a good junction with the concrete work by working the dirt into the angles made by the cut-off walls and other irregularities built on the back of the concrete wall for bonding purposes, and by careful wetting down of the material next to the wall.

The work was done in one and one-half months. Chas. Crampton, of R. R. No. 5, had the contract for excavating, transporting, and placing the material. The "plastic fill" operations were conducted by the District's own forces.

The caterpillar tractor was taking a wagon load of earth down a two-to-one slope. A stout block took the place of the ordinary wagon tongue. The east wall of the outlet structure was at the bottom of the slope. Horses could not hold the wagons on the slope, nor prevent them from smashing up against the wall. With the tractor in use, a stop could be made any place in the slope, or a turn made. At the bottom, close to the wall, the short turns were made without smashing a single wagon. The wet grade made by the plastic fill method did not stall the tractor.

FIG. 328.—HANDLING LOADED WAGONS ON A STEEP SLOPE AT TAYLORSVILLE, JUNE 1, 1921.

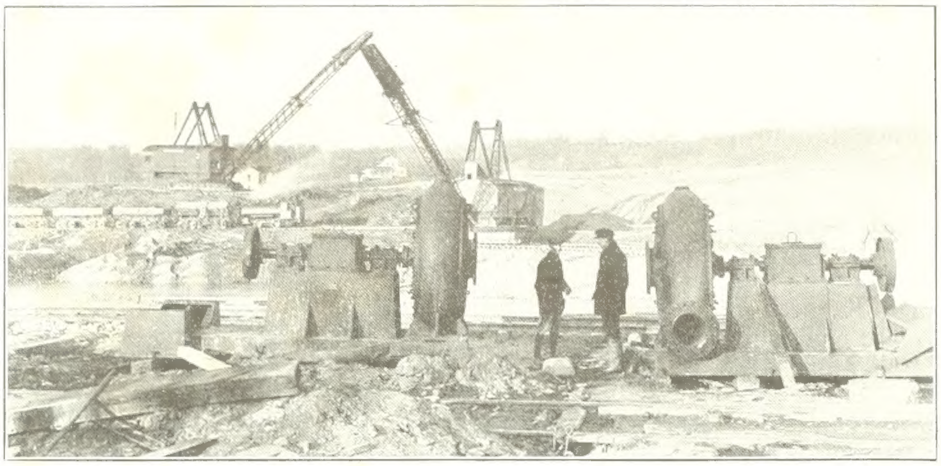
FOR SALE

CONSTRUCTION EQUIPMENT

AND SUPPLIES

THE MIAMI CONSERVANCY DISTRICT

is finishing up its work. A small part of its constructton plant and supplies a.e now for sale By late fall a large part of the $2,000,000 worth of construction equipment will be released This includes 20 Draglines in various sizes, 15 Locomotives, 100 12-yard Dump Cars, Concrete Mixers, Electric Motors, Transformers, and other equipment.



Make your plans now to take advantage of this opportunity to secure first-class construction machinery at a marked reduction. Send for complete list.

FOR SALE FOR IMMEDIATE SHIPMENT

The following equipment is all in first-class condition:

BOILERS

2—Gem City 15 H. P. Horizontal Boilers, 100 lb. pressure.
1—Gem City 25 H. P. Horizontal Boiler, 100 lb. pressure.
1—15 H. P. Brownell Scotch Boiler, 15 lb. pressure, horizontal, mounted on skids, 44 in. x 70 in.

DUMP CARS

12—Western air dump standard gauge cars, 50,000 lb. capacity.
3—4 yd. 36 gauge Side Dump Cars, wooden body over draft beam.
6—1½ yd. Steel V-shape Side Dump Cars.

AIR COMPRESSOR

1—Sullivan air compressor, 10 x 10, belt driven, capicity 213 cu. ft. free air per minute at 100 lb.

DRILLS

6—Sullivan Class 2, steam or air rock drills, 3¼ cylinder.
1—Sanderson Cyclone Class B non-traction well drill, with 24 ft. derrick.
8—Ingersoll-Rand E-44 Steam or air rock drills.
4—Ingersoll-Rand Butterfly Jack Hammer Drills.
4—Sullivan Class D.P. 33, Solid Piston Rotator Type Drills.
1—Sullivan Steam Submarine Drill, Class F. V. 14, 5 in. diameter.

DRAGLINES

(Ready for September delivery.)

1—Lidgerwood Class M. Electric Dragline Excavator, truck mounted, 100 ft. boom for 3½ to 4 yd. bucket.
1—Lidgerwood Class B. Steam Dragline Excavator, truck mounted; 60 ft. boom, 1½ yard bucket.

MISCELLANEOUS

7—Buckets, 1½ yard bottom dump, concrete, double bale.
4—Spud Hoists for use on dredge or scow, with or without motors.
1—3 H. P. International Harvester gas engine, vertical.
2—6 H. P. Foss Horizontal gas engine.
Weinman brass fitted automatic pump with receivers 3½ x 2¼ x 5.
Complete equipment for stern wheel steam tug, including stern wheel steam boat engine. 8¼ x 42 in. and 5 in x 16 ft. Also a 60 H. P. Marine Boiler.
2000 ft. 18 in. I. D. Machine, banded wood stave wood pipe for 10 ft. head, complete with couplings and fittings.
2—No. 2 Vulcan Steam Pile Hammers, with standard base, weight striking part 3000 lbs.
1—No. 4 Vulcan Steam Pile Hammer, with standard base. weight striking part 550 lb.

MOTORS

1—5 H. P. Fairbanks-Morse Motor induction, 3 phase, 440 volts.
3—20 H. P. Wagner motors for industrial elevator, 3 phase, 440 volt.
1—22 H. P. G. E. Motor 440 volt, 3 phase.
1—30 H. P. Allis-Chalmers squirrel cage motor, 3 phase. 440 volt.
7—50 H. P. Westinghouse squirrel cage induction motor, 3 phase, 440 volt.

SUPPLIES

Hardware and builders' supplies, cafeteria and hotel equipment, groceries, plumbers' supplies, tools, a complete bake shop, camp supplies, pulleys, iron rivets, and electrical supplies and equipment.

Contractors desiring to equip a job can be completely supplied from the goods we now have for sale

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